CLAIMS

What is claimed is:

1. An ultrasonic medical device comprising:

an ultrasonic probe comprising a proximal end, a distal end and a longitudinal axis therebetween;

a transducer creating a torsional vibration of the ultrasonic probe;

a coupling engaging the proximal end of the ultrasonic probe to a distal end of the transducer; and

an ultrasonic energy source engaged to the transducer that produces an ultrasonic energy.

2. The ultrasonic medical device of claim 1 wherein the torsional vibration of the ultrasonic probe causes a rotation and counterrotation along the longitudinal axis of the ultrasonic probe.

3. The ultrasonic medical device of claim 1 wherein the torsional vibration of the ultrasonic probe is propagated in a forward direction and a reverse direction about a plurality of torsional nodes along a portion of the longitudinal axis of the ultrasonic probe.

4. The ultrasonic medical device of claim 1 wherein a portion of the longitudinal axis of the ultrasonic probe comprises a radially asymmetric cross section.

5. The ultrasonic medical device of claim 4 wherein cavitation occurs around the portion of the longitudinal axis of the ultrasonic probe comprising the radially asymmetric cross section to ablate a biological material.

6. The ultrasonic medical device of claim 1 wherein the torsional vibration of the ultrasonic probe produces a plurality of torsional nodes and a plurality of torsional anti-nodes along a portion of the longitudinal axis of the ultrasonic probe.

7. The ultrasonic medical device of claim 1 wherein a length of the longitudinal axis of the ultrasonic probe comprises an approximately rectangular shaped cross section.

8. The ultrasonic medical device of claim 1 wherein a length of the longitudinal axis of the ultrasonic probe comprises a spline shape.

9. The ultrasonic medical device of claim 1 wherein a plurality of projections extend from an outer surface along a length of the ultrasonic probe.

10. The ultrasonic medical device of claim 1 wherein a length of the longitudinal axis of the ultrasonic probe has a cross sectional shape selected from the group consisting of elliptical, star shaped, rectangular, oval, triangular, trapezoidal, circular with a flat spot and square.

11. The ultrasonic medical device of claim 1 wherein the torsional vibration generates acoustic energy in a medium surrounding the ultrasonic probe.

12. The ultrasonic medical device of claim 1 wherein the ultrasonic energy source delivers ultrasonic energy in a frequency range from about 10 kHz to about 100 kHz.

13. The ultrasonic medical device of claim 1 wherein the ultrasonic energy source provides an electrical power to the transducer at a resonant frequency of the transducer by finding the resonant frequency of the transducer.

14. The ultrasonic medical device of claim 1 wherein the ultrasonic probe supports the torsional vibration when flexed.

15. The ultrasonic medical device of claim 1 wherein the ultrasonic probe has a flexibility allowing the ultrasonic probe to be deflected and articulated.

16. The ultrasonic medical device of claim 1 wherein the ultrasonic probe comprises a substantially uniform cross section from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

17. The ultrasonic medical device of claim 1 wherein the ultrasonic probe comprises a varying cross section from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

18. The ultrasonic medical device of claim 1 wherein the ultrasonic probe is disposable.

19. A medical device comprising:

an elongated probe comprising a proximal end, a distal end, and a longitudinal axis between the proximal end and the distal end wherein a portion of the longitudinal axis comprises a radially asymmetric cross section;

a transducer that converts electrical energy into mechanical energy, creating a torsional vibration along the longitudinal axis of the elongated probe;

a coupling engaging the proximal end of the elongated probe to a distal end of the transducer; and

an ultrasonic energy source engaged to the transducer that provides the electrical energy to the transducer,

wherein the torsional vibration along the elongated probe produces a plurality of torsional nodes and a plurality of torsional anti-nodes along a portion of the longitudinal axis of the elongated probe.

20. The medical device of claim 19 wherein the torsional vibration of the elongated probe produces a rotation and a counterrotation along the longitudinal axis of the elongated probe.

21. The medical device of claim 19 wherein the torsional vibration of the elongated probe is propagated in a forward direction and a reverse direction about the plurality of torsional nodes of the elongated probe.

22. The medical device of claim 19 wherein the torsional vibration generates acoustic energy in a medium surrounding the elongated probe.

23. The medical device of claim 19 wherein cavitation occurs over an active area of the elongated probe along the portion of the longitudinal axis comprising the radially asymmetric cross section. .

24. The medical device of claim 19 wherein a length of the longitudinal axis of the elongated probe comprises a spline shape.

25. The medical device of claim 19 wherein a length of the longitudinal axis of the elongated probe has a cross sectional shape selected from the group consisting of elliptical, star shaped, rectangular, oval, triangular, trapezoidal, circular with a flat spot and square.

26. The medical device of claim 19 wherein a plurality of projections extend from an outer surface along a length of the elongated probe.

27. The medical device of claim 19 wherein the ultrasonic energy source delivers ultrasonic energy in a frequency range from about 10 kHz to about 100 kHz.

28. The medical device of claim 19 wherein the ultrasonic energy source provides an electrical power to the transducer at a resonant frequency of the transducer by finding the resonant frequency of the transducer.

29. The medical device of claim 19 wherein the elongated probe supports the torsional vibration when flexed.

30. The medical device of claim 19 wherein the elongated probe has a flexibility allowing the elongated probe to be deflected and articulated.

31. The medical device of claim 19 wherein the elongated probe comprises a substantially uniform cross section from the proximal end of the elongated probe to the distal end of the elongated probe.

32. The medical device of claim 19 wherein the elongated probe comprises a varying cross section from the proximal end of the elongated probe to the distal end of the elongated probe.

33. The medical device of claim 19 wherein the elongated probe has an approximately circular cross section.

34. A method of treating a biological material in a body with an ultrasonic medical device comprising:

providing the ultrasonic medical device comprising an ultrasonic probe having a proximal end, a distal end and a longitudinal axis therebetween wherein a portion of the longitudinal axis comprises a radially asymmetric cross section;

moving the ultrasonic probe to a treatment site of the biological material to place the ultrasonic probe in communication with the biological material; and

activating an ultrasonic energy source engaged to the ultrasonic probe to produce an ultrasonic energy that is converted into a torsional vibration of the ultrasonic probe.

35. The method of claim 34 further comprising creating the torsional vibration along the longitudinal axis of the ultrasonic probe with the ultrasonic energy source engaging a proximal end of a transducer and the ultrasonic probe engaging a distal end of the transducer.

36. The method of claim 34 further comprising generating acoustic energy in a medium surrounding the ultrasonic probe through the torsional vibration of the ultrasonic probe.

37. The method of claim 34 further comprising producing a plurality of torsional nodes and a plurality of torsional anti-nodes along a portion of the longitudinal axis of the ultrasonic probe by the torsional vibration of the ultrasonic probe.

38. The method of claim 34 wherein cavitation occurs around an active area of the ultrasonic probe comprising the portion of the longitudinal axis having the radially asymmetric cross section.

39. The method of claim 34 wherein a length of the longitudinal axis of the ultrasonic probe comprises a spline shape.

40. The method of claim 34 wherein a length of the longitudinal axis of the ultrasonic probe has a cross sectional shape selected from the group consisting of elliptical, star shaped, rectangular, oval, triangular, trapezoidal, circular with a flat spot and square.

41. The method of claim 34 wherein a plurality of projections extend from an outer surface along a length of the ultrasonic probe.

42. The method of claim 34 further comprising producing a rotation and counterrotation along the longitudinal axis of the ultrasonic probe by the torsional vibration of the ultrasonic probe.

43. The method of claim 34 further comprising projecting the torsional motion of the ultrasonic probe in a forward direction and a reverse direction about a plurality of torsional nodes of the ultrasonic probe.

44. The method of claim 34 further comprising sweeping the ultrasonic probe along the treatment site of the biological material.

45. The method of claim 34 further comprising moving the ultrasonic probe back and forth along the treatment site of the biological material.

46. The method of claim 34 further comprising rotating the ultrasonic probe along the treatment site of the biological material.

47. The method of claim 34 further comprising delivering ultrasonic energy in a frequency range from about 10 kHz to about 100 kHz by the ultrasonic energy source.

48. The method of claim 34 further comprising providing an electrical power to a transducer at a resonant frequency of the transducer of the ultrasonic medical device by the ultrasonic energy source determining the resonant frequency of the transducer.

49. The method of claim 34 further comprising providing the ultrasonic probe having a flexibility allowing the ultrasonic probe to be deflected and articulated.

50. The method of claim 34 further comprising providing the ultrasonic probe having a flexibility to support the torsional vibration when flexed.

51. The method of claim 34 further comprising providing the ultrasonic probe having a substantially uniform cross section from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

52. The method of claim 34 further comprising providing the ultrasonic probe having a varying cross section from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

53. A method of removing a biological material in a body comprising:

providing an ultrasonic medical device comprising an ultrasonic probe having a proximal end, a distal end that terminates in a probe tip and a longitudinal axis between the proximal end and the distal end;

moving the ultrasonic probe in the body and placing the ultrasonic probe in communication with the biological material; and

activating an ultrasonic energy source of the ultrasonic medical device to produce an electric signal that drives a transducer of the ultrasonic medical device to produce a torsional vibration of the ultrasonic probe, wherein the torsional vibration of the ultrasonic probe produces a plurality of torsional nodes and a plurality of torsional anti-nodes along a portion of the longitudinal axis of the ultrasonic probe.

54. The method of claim 53 wherein a portion of the longitudinal axis of the ultrasonic probe has a radially asymmetric cross section.

54. The method of claim 53 wherein the plurality of torsional nodes are points of a minimum torsional vibration.

55. The method of claim 53 wherein the plurality of torsional anti-nodes are points of a maximum torsional vibration.

56. The method of claim 53 further comprising producing a rotation and counterrotation along the longitudinal axis of the ultrasonic probe by the torsional vibration of the ultrasonic probe.

57. The method of claim 53 further comprising projecting the torsional vibration of the ultrasonic probe in a forward direction and a reverse direction about the plurality of torsional nodes of the ultrasonic probe.

58. The method of claim 60 wherein cavitation occurs along an active area of the ultrasonic probe along a portion of the longitudinal axis comprising a radially asymmetric cross section.

59. The method of claim 53 wherein cavitation occurs at the probe tip.

60. The method of claim 53 wherein a length of the longitudinal axis of the ultrasonic probe comprises a spline shape.

61. The method of claim 53 wherein a length of the longitudinal axis of the ultrasonic probe comprises a cross sectional shape selected from the group consisting of elliptical, star shaped, rectangular, oval, triangular, trapezoidal, circular with a flat spot and square.

62. The method of claim 53 further comprising delivering ultrasonic energy in a frequency range from about 10 kHz to about 100 kHz by the ultrasonic energy source.

63. The method of claim 53 wherein the ultrasonic probe is for a single use on a single patient.

64. An ultrasonic probe comprising:

a proximal end;

a distal end that terminates in a probe tip; and

a longitudinal axis between the proximal end and the distal end, a portion of the longitudinal axis of the ultrasonic probe comprising a radially asymmetric cross section to support a torsional vibration.

65. The ultrasonic probe of claim 64 wherein the ultrasonic probe comprises a varying cross section from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

66. The ultrasonic probe of claim 64 wherein a cross section of the proximal end of the ultrasonic probe is approximately circular.

67. The ultrasonic probe of claim 64 wherein the radially asymmetric cross section comprises a spline shape.

68. The ultrasonic probe of claim 64 wherein the radially asymmetric cross section has a cross sectional shape selected from the group consisting of elliptical, star shaped, rectangular, oval, triangular, trapezoidal, circular with a flat spot and square.

69. The ultrasonic probe of claim 71 wherein the ultrasonic probe comprises a varying diameter from the proximal end of the ultrasonic probe to the distal end of the ultrasonic probe.

70. The ultrasonic probe of claim 64 wherein the ultrasonic probe has a flexibility allowing the ultrasonic probe to be deflected and articulated.